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(54) SELF-SEALING PUNCTURABLE ARTICLES

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(57) The inclusion of these self-sealing articles in a water-bed mattress, a swimming pool and a roof is also claimed.

Claim

1. A self-sealing article comprising:

- a) a flexible, puncturable sheet formed of cloth or polymeric material, the sheet being less than 0.254 cm (100 mils) thick;
- b) a layer of a self-adhering, water-resistant, sealing material for sealing punctures in the sheet, the layer being less than 0.254 cm (100 mils) thick, the sealing material covering at least a portion of one of the surfaces of the sheet, the sealing material being sufficiently tacky that it adheres to the sheet and can be pulled into a puncture in the sheet by the object that causes the puncture, the sealing material having a sufficiently high viscosity at 38°C (100°F) that it does not flow through a puncture in the sheet, the sealing material comprising a polyurethane elastomer; and
- c) an air-tack barrier on the layer of sealing material for preventing the layer of sealing material from sticking to itself.

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Complete Specification for the invention entitled:

"SELF-SEALING PUNCTURABLE ARTICLE"

The following statement is a full description of this invention,
including the best method of performing it known to us.

ABSTRACT

Flexible self-sealing sheeting comprises a flexible, puncturable sheet of cloth or polymeric material, a layer of a self-adhering, water-resistant polyurethane sealing material, and an anti-tack barrier. The sheeting can be used to form a waterbed mattress, swimming pool, tent, inflatable boat, tarp, roof, and other self-sealing articles.

5

SELF-SEALING PUNCTURABLE ARTICLE

CROSS-REFERENCES

This application is a continuation-in-part of Application Serial No. 474,545 filed March 11, 1983. This application is related to Application Serial No. 134,628 filed March 27, 1980, now U. S. Patent No. 4,382,303 and U. S. Patent Application Serial No. 421,369 filed on September 22, 1982. Application Serial No. 421,369 is a continuation of Application Serial No. 134,628.

BACKGROUND

This invention relates to puncturable articles formed of cloth or polymeric materials.

Mankind has always been plagued with articles that leak when they are not supposed to leak. Swimming pools, tents, roofs, rafts, inflatable toys, and waterbed mattresses all share a common feature, namely they are all susceptible to developing leaks, often with disastrous consequences.

These and other useful articles are formed from a thin, puncturable sheet of cloth such as canvas or polymeric materials such as polyvinyl chloride or polyethylene. It is desirable to use these materials. For example, for waterbed mattresses polyvinyl chloride is an excellent material to use in that it is durable, flexible, and can easily be bonded to itself by adhesives and heat for forming sheets into the configuration of a waterbed.

Unfortunately, an owner of a waterbed mattress, forgetting that he does not have a conventional mattress, can stick a pin into the mattress, thereby causing a leak. Also, cats and other domestic animals are known to rip waterbed mattresses, rafts, and other items.

Leaks from these articles can be, at a minimum, inconvenient, and in some cases disastrous. A leaking swimming pool or waterbed mattress can create property damage. A leaking raft could result in loss of human life.

In view of these problems, there is a need for non-leaking, self-sealing articles formed from flexible sheets of cloth and polymeric material.

SUMMARY

The present invention is directed to a self-sealing article having these features. The article is designed to hold fluid such as water or air inside of it, i.e. it functions as a container or it is designed to keep fluid out of a space, i.e. such as a tent.

The article comprises a flexible, puncturable sheet formed of cloth or polymeric material. The article is provided with an internal layer or film of a sealing material for sealing punctures in the sheet. In the absence of the sealing material, the article, when punctured or torn, develops a fluid leak where a fluid such as water or pressurized air leaks into or out of the article.

The sealing material is a self-adhering, water-

resistant material that has a sufficiently high viscosity at 38°C (100°F) that it does not flow through a puncture in the sheet. The sealing material is sufficiently tacky that it adheres to the sheet and is pulled into a puncture in the sheet by the object that causes the puncture and seals the puncture against fluid leakage there-through. A preferred sealing material is a tacky, non-foaming polyurethane, preferably a polyether polyurethane such as a polyurethane comprising a reaction product of a polyoxypropylene glycol and toluene diisocyanate.

The sheet is generally less than 0.254 cm (100 mils) thick. The sealing material preferably is provided in a layer or film of less than 0.254 cm (100 mils) of thickness, preferably less than 0.127 cm (50 mils) thick, and more preferably in a thickness of from 0.063 cm (25 mils) to 0.102 cm (40 mils). The thicker the layer, the larger the hole that can be sealed.

A barrier is provided on the surface of the sealing material not in contact with the sheet to keep the layer of sealing material from sticking to itself. Thus, sealing material is sandwiched between the barrier and the flexible sheet. The barrier preferably is a polyethylene film.

One technique for forming articles of the present invention is to form sheeting comprising the sheet of flexible material, the self-sealing material, and the barrier. This sheeting can then be fabricated into the desired shape.

Alternatively, a sheet of canvas or polymeric material can be fabricated into the shape of the article, and then the sealing material and barrier can be applied.

5 By provision of the sealing material, minor punctures and rips that occur in the article are automatically sealed. This prolongs the life of the article, can be an important safety feature for articles such as life rafts, and can prevent damage that can occur from leaks such as damage from water in a waterbed
10 mattress spilling onto surrounding floor surfaces.

DRAWINGS

These and other features, aspects, and advantages of the present invention will become better understood with reference to the following description,
15 appended claims, and accompanying drawings where:

Fig. 1 is a perspective view, partly in section, of sheeting according to the present invention;

20 Fig. 2 is a sectional view of another version of sheeting according to the present invention taken along a line corresponding to line 2-2 of Fig. 1;

Fig. 3 is a perspective view, partly in section, of a waterbed mattress according to the present invention;

25 Fig. 4 is a sectional view of another version of a waterbed mattress according to the present invention taken along a line corresponding to line 4-4 of Fig. 3;

Fig. 5 is a perspective view of a swimming pool according to the present invention;

Fig. 6 is a view vertical section of the swimming pool of Fig. 5 taken along 6-6 of Fig. 5;

Fig. 7 is a perspective view, partly in section, of a tent according to the present invention; and

Fig. 8 is a sectional view of a roof according to the present invention.

5

DESCRIPTION

The present invention is directed to a self-sealing article. With reference to Figs. 1 and 2, the self-sealing article can be a piece of sheeting 10 comprised of three parts. The sheeting includes a flexible, puncturable sheet 12 formed of cloth (as shown in Fig. 2) or polymeric material (as shown in Fig. 1). Adhered to a surface 13 the sheet 12 is a layer 14 of a self-adhering, water-resistant sealing material for sealing punctures in the sheet 12. The sealing material 14 covers at least a portion of one of the surfaces of the sheet 12, and preferably covers the entire surface 13 of the sheet 12. A barrier 16 of anti-tack material adheres to the layer 14 of sealing material for preventing the sealing material from sticking to itself when the sheeting 10 is folded or shipped.

The sheet 12 is formed of a broad stretch or surface of cloth or polymeric material that is flexible, i.e. the sheet 12 can be repeatably flexed and can be folded upon itself.

The sheeting 10 and sheet 12 are both flexible and also pliable, i.e. they are supple enough to bend freely and repeatedly without breaking.

Suitable materials for the sheet 12 are materials made by weaving, felting, or knitting natural and synthetic fibers and filaments, as well as sheets made from polymer such as neoprene, nylon, polyvinyl chloride, polyethylene, urethanes, and the like.

The sheet 12 is generally thin, in the order of less than about 0.254 cm (100 mils) thick, and preferably less than 0.127 cm (50 mils) thick.

The sealing material is formed of a self-adhering, water-resistant material, and preferably a polymeric material. By the term "self-adhering" there is meant a material that when torn into two portions and recontacted to itself, the tensile strength of the recontacted portions at the interface is about the same as the tensile strength of the undisturbed material.

The sealing material serves to automatically seal punctures, rips, cuts and the like in the sheet 12 resulting from domestic animals, pins, nails, knives and razors. In order for the sealing material to function properly, it requires specific rheological properties. It needs to have a sufficiently low viscosity at room temperature, on the order of about 16°C (60°F), that it can flow into a puncture hole. It needs to have a sufficiently high viscosity, even at the maximum elevated operating temperatures of the sheeting, that it does not flow all the way through a puncture in the envelope, i.e. it does not leak out through the sheet.

To determine if a candidate sealing material meets these requirements, a simple test can be conducted. The sealing material is placed in a layer of about 0.013 cm (5 mils) to 0.0254 cm (10 mils) thick between two polyethylene bags, each bag being about 0.0102 cm (4 mils)

in thickness. The internal bag is filled with about a quart of water at a selected temperature. Both bags are then punctured with a nail to produce a hole of about 0.16 cm (1/16 inch) in diameter. A satisfactory sealing material is one that seals the hole and prevents water from leaking out at about 16°C (60°F) to 38°C (100°F), but does not flow out of the hole at 38° (100°F).

Another requirement for the sealing material is that it stays in position as a film or layer adjacent the sheet 12, even on vertical surfaces. In addition, the sealing material should not adversely affect the sheet 12, or any other materials with which the sealing material comes in contact. Preferably the sealing material contains nothing that can migrate through the sheet 12 and is deleterious to the health of the user of an article formed from the sheeting 10.

Preferably the sealing material is provided in a film or layer 14 less than about 0.254 cm (100 mils, i.e. 0.100 inch), because thicker films decrease the flexibility and increase the cost of the sheeting. If the thickness is much less than about 0.063 cm (25 mils), holes larger than 0.127 cm (50 mils) in diameter may not be automatically sealed. Thus, preferably the sealing material is provided in a layer 14 of at least about 0.063 cm (25 mils), and preferably from about 0.063 cm (25 mils) to about 0.102 cm (40 mils) in thickness, to seal holes 0.127 cm (50 mils) in diameter.

The preferred material for the sealing material is a tacky polyurethane, either a poly(ester) polyurethane or a poly(ether)polyurethane of sufficiently high viscosity to satisfy these rheological requirement and sufficiently

tacky to adhere to the surface 13 of the sheet 12. Preferably poly(ether)- polyurethanes are used because of their hydrolytic stability for applications in which the sheeting 10 contacts water.

5 Preferably the polyurethane is non-foamed because a foamed material would result in bulky sheeting. However, a foamed material can be used to obtain the advantage of heat insulation.

10 Preferably the polyurethane is the reaction product of a polyisocyanate reactant and a polyether reactant. The aromatic diisocyanates are preferred. Especially preferred are the toluene diisocyanate isomers. The commercially available blends of the 2,4- and 2,6- isomers are effective; the 80:20 and 65:35 blends are most readily available.

20 The polyether reactants are hydroxyl group terminated polyfunctional polyethers of the type commonly used in poly-(ether)urethane formulations. Preferred are the polyoxy alkylene polyols having 2-4 hydroxyl groups where the alkylene has 2-6 carbon atoms. The condensation can involve an alkylene oxide, such as ethylene oxide, propylene oxide, or butylene oxide, with a glycol. Higher polyethers can be obtained by reaction with a triol or high polyols, such as glycerine, trimethylolpropane, and pentaerythritol.

25 Polyols of the above types are available commercially, for example: Veracols (trademark) from Dow Chemical Company; Poly-G (trademark) from Olin Chemicals Division; Pluracols (trademark) from BASF Wyandotte

Corporation, and Niax (trademark) from Union Carbide.

A preferred polyether reactant comprises polyoxypropylene glycol, comprising diols and triols, and preferably at least about 10 mole percent triols.

5 The isocyanate and the diol polyether can be combined to form prepolymers, one prepolymer where substantially all of the terminal groups are isocyanate groups and a second prepolymer where substantially all of the terminal groups are hydroxy groups.

10 The poly(ether)urethane elastomer, which is essentially free of voids, can be formed by combining the two prepolymer preparations in the presence of a catalyst. Alternatively, and preferably, the isocyanate terminated prepolymer can be combined with the unreacted polyols.
15 Also the hydroxy terminated prepolymer can be combined with unreacted isocyanate. For room temperature curing, preferably a tin catalyst is used.

20 An excess of polyol is preferred so that the mole ratio of hydroxy groups to isocyanate groups is about 1.01 to about 1.05.

EXAMPLE 1

25 A preferred poly(ether)urethane elastomer was prepared from toluene diisocyanate and polyoxypropylene glycol. The final product had an elongation of 1500%, a tensile strength of 7.03 kg/cm² (100 psi), adhered both to polyvinylchloride sheet and polyethylene sheet, and a flow

temperature greater than 135°C (275°F). It had a shore A hardness of zero and a tear strength Die C of 15 ± 5 pli. The product had a gel time of about 15 minutes for 200 grams mixed at 22°C (72°F). The polyol component, which
5 contains the catalyst, had a viscosity at 22°C (72°F) of 770 cp and a specific gravity at 22°C (72°F) of 1.027. The prepolymer component, which is isocyanate terminated, had a viscosity at 22°C (72°F) of about 750 cp and a specific gravity at 22°C (72°F) of 1.034. They were
10 combined in 1:1 proportions by volume.

Such a material is available from Synair Corporation of Chattanooga, Tennessee, Formula 4343.

It has been found that a 0.018 cm (7 mil) layer of this material can seal a pin hole 0.063 (25 mils) in
15 diameter.

EXAMPLE 2

Another satisfactory material is formed from (a) 1 mole of Union Carbide Niax PPG 2025 diol which has an equivalent weight of 1000, (b) 1 mole of Union Carbide
20 Niax PPG 168 triol which has an equivalent weight of 1000, and (c) 1.98 moles of toluene diisocyanate of equivalent weight of 87. Dibutyltin dilaurate was used as a catalyst at a level of 0.1% by weight of the reactants. The product polymerized at room temperature.

25 If desired, the diol, diisocyanate and catalyst can be heated together in a flask at 60°C (140°F) to form an isocyanate terminated prepolymer, which can then be

reacted with the triol at room temperature.

5 A barrier 16 that conforms generally to the shape of the envelope 12 is provided. The barrier 16 of anti-tack material adheres to the sealing material and prevents the sealing material from sticking to itself. When sheeting 10 and the other articles according to the present invention are shipped, they can be folded. Without the barrier 16, the tacky sealing material would stick to itself during shipping.

10 Preferably the barrier 16 is a thin sheet of polymeric material that maintains its flexibility and tear resistance over a long life and in contact with water. The preferred material for the barrier 16 is polyethylene. A satisfactory barrier has been made from polyethylene
15 that is only 0.00127 cm (1/2 mil) - 0.00254 cm (1 mil) thick.

The barrier can also be an anti-tack agent such as talc or other material that renders the internal surface of the layer of sealing material non-tacky.

20 The barrier can also be a non-tacky film that forms in situ on the surface of the sealing material. This can be accomplished with polyurethane sealants by producing a material with excess isocyanate groups, and exposing the material to moist air. A non-tacky skin
25 forms on the surface of the sealing material with this technique. The sealing material preferably is at least 0.63 cm (1/4 inch) thick to be sure that a portion of the layer of sealing material remains tacky. Thus, this

technique may not be acceptable for applications where weight is an important consideration.

The relative thickness of the layers is not necessarily shown to scale in any of the Figures.

5 The sheeting 10 can be used for forming many articles. An article can be formed into the desired shape with the sheeting 10 by use of adhesives, stitching, heat welding, ultrasonic welding, and other techniques that would be used for the sheet 12 by itself.

10 Alternatively, articles according to the present invention can be formed by starting with the sheet 12 of cloth or polymeric material and forming that into a desired shape. Then, the sealing material and barrier can be applied to the formed sheet.

15 A variety of articles can be made self-sealing according to the present invention. Such articles generally fall into two categories. The first category is containers that hold fluids such as air or water. Exemplary of such containers are waterbed mattresses, inflatable
20 toys, life preservers, boats, rafts, balloons, and the like.

A second category is articles designed to keep a fluid such as water or air out of a space. Exemplary of such articles are tents, tarps, and roofs.

25 With reference to Figs. 3 and 4, there is shown a self-sealing waterbed mattress 20 according to the present

invention. Like a conventional waterbed mattress, the waterbed mattress 20 comprises an exterior, generally rectangular enclosure or envelope 22 that defines the side 24, top 26 and bottom 28 walls or surfaces of the waterbed mattress 20. The top wall 26 of the waterbed mattress 20 serves as a sleeping surface and is adapted for receiving persons in sitting and reclining positions. The mattress 20 is provided with a fill and drain valve 30.

The envelope 22 is of conventional construction and is generally formed of flexible, plasticized polyvinyl-chloride. Its thickness is in the range of from about 0.254 cm (10 mils) to about 0.763 cm (30 mils), and preferably about 0.508 cm (20 mils). The envelope can be formed according to conventional techniques using adhesives and heat welding, and preferably by heat welding the seams. It can be formed by bonding two planar sheets together along their periphery or by bonding upstanding sheets between the edges of the top and bottom walls to form a contoured or fitted structure.

On the internal surface 32 of the envelope 22 is a thin film or layer 34 of a sealing material that serves to seal any leaks that form in the envelope.

A two component polyurethane sealing material is particularly adapted for manufacture of a waterbed mattress where the mattress is formed from two sheets, a top sheet and a bottom sheet. Before the polyurethane cures, it has a relatively low viscosity. Therefore it can easily be sprayed or brushed onto the internal surface of the top sheet of the envelope. Then a barrier layer 40 is placed

on the layer of sealing material after it has at least partially cured. Because the sealing material is tacky it adheres to the top sheet of the envelope and the barrier sheet 40 adheres to the sealing material. Then the bottom and top sheets are secured together in the conventional fashion such as heat welding to form the mattress.

As shown in Fig. 4, there is no sealing material along the bottom wall 28 of the mattress. However, it is unusual for the leak to form in the bottom wall of the mattress since it rests on the floor of a pedestal. Thus the sealing material is present where needed, namely along the side walls and top wall of the mattress.

Of course, sealing material can be on all of the walls of the mattress by coating all of the sheets used to form the mattress with sealing material.

In one version of the invention, the barrier can be a relatively thick layer of polyethylene or polyurethane foam, i.e., in the order of about 0.32 cm (1/8") thick. An advantage of using foam as the barrier is that the foam provides heat insulation to the mattress, reducing the amount of energy required for maintaining the water in the mattress at the desired temperature.

Figs. 5 and 6 show an inflatable swimming pool 50 which is exemplary of inflatable toys according to the present invention. The swimming pool 50 comprises an inflatable, peripheral side 52 and a bottom 54 that sits on the ground. The side 52 and bottom 54 form an enclosure that is filled with water.

With reference to Fig. 6, the side 52 comprises an inner wall 54 and an outer wall 56 sealed together to form an air chamber 58. Each wall 54 and 56 comprises an outer sheet 60 of polymeric material such a polyvinyl chloride, a middle layer 62 of self sealing material, and an inner barrier 64 of anti-tack material.

Punctures in the side walls 54 and 56 are sealed by the self-sealing material, and the two layers of sealing material do not stick together because of the barriers 64.

Fig. 7 shows a tent 80, the side walls 82 of which are formed from the sheeting 10 of Fig. 2, where the sheet 12 is made from canvas. The side walls include the layer 14 of self-sealing material and the barrier 16. Thus, even if the tent is punctured, a camper will not wake up wet.

With reference to Fig. 8, a roof 90 has an underlying wood substrate 92. The wood is covered with the sheeting 10 of Fig. 1 and 2 where the sheet 12 is formed from polyvinyl chloride containing anti-oxidants. The barrier 16 is in contact with the wood substrate 92. Piled on top of the sheeting 10 in contact with the top surface of the sheet 12 is gravel 94 or other rock material. If desired, layers of tar paper and asphalt can be used.

Because of the presence of the sealing material, punctures in the plastic layer 12 often do not result in leaks.

Although the present invention has been described in considerable detail with reference to certain preferred versions thereof, other versions are possible. Therefore the spirit and scope of the appended claims should not necessarily be limited to the description of the preferred versions contained herein.

5

~~What is claimed is:~~

The claims defining the invention are as follows:

1. A self-sealing article comprising:
 - a) a flexible, puncturable sheet formed of cloth or polymeric material, the sheet being less than 0.254 cm (100 mils) thick;
 - 5 b) a layer of a self-adhering, water-resistant, sealing material for sealing punctures in the sheet, the layer being less than 0.254 cm (100 mils) thick, the sealing material covering at least a portion of one of the surfaces of the sheet, the sealing material being
10 sufficiently tacky that it adheres to the sheet and can be pulled into a puncture in the sheet by the object that causes the puncture, the sealing material having a sufficiently high viscosity at 38°C (100°F) that it does not flow through a puncture in the sheet, the sealing
15 material comprising a polyurethane elastomer; and
 - c) an anti-tack barrier on the layer of sealing material for preventing the layer of sealing material from sticking to itself.
2. The article of claim 1 in which the elastomer is a polyether polyurethane elastomer.
3. The article of claim 1 in which the layer of sealing material is less than 0.127 cm (50 mils) thick.
4. The article of claim 3 in which the layer of sealing material is from about 0.063 cm (25 mils) to about 0.102 cm (40 mils) thick.
5. The article of claim 2 in which the polyurethane comprises the reaction product of (i) polyoxypropylene glycol or polyoxybutylene glycol and (ii) an aromatic diisocyanate.

6. A waterbed mattress comprising a flexible top wall, a flexible side wall, and a flexible bottom wall, each wall having an inside surface for holding water in the mattress, at least one of the walls comprising:

5 a) an outer, flexible puncturable sheet formed of a polymeric material sheet, the sheet being less than 100 mils thick;

10 b) a middle layer of a self-sealing, water-resistant sealing material for sealing punctures in the sheet, the middle layer being less than 0.254 cm (100 mils) thick, the sealing material being sufficiently tacky that it adheres the sheet and can be pulled into a puncture in the sheet by the object that causes the puncture, the sealing material having a sufficiently high
15 viscosity at 38°C (100°F) that it does not flow through a puncture in the sheet, the sealing material comprising a polyurethane elastomer; and

20 c) an inner anti-tack barrier adhered to the layer of the sealing material for preventing the layer of sealing material from sticking to itself.

7. The mattress of claim 6 in which the elastomer is a polyether polyurethane elastomer.

8. The mattress of claim 6 in which the layer of sealing material is less than 0.127 cm (50 mils) thick.

9. The mattress of claim 8 in which the layer of sealing material is from about 0.063 cm (25 mils) to about 0.102 cm (40 mils) thick.

10. The mattress of claim 8 in which the polyurethane comprises the reaction product of (i)

polyoxypropylene glycol or polyoxybutylene glycol and (ii) an aromatic diisocyanate.

11. A self-sealing swimming pool comprising a wall for holding water in the pool, the wall comprising:

a) an outer, flexible, sheet of puncturable polymeric material, the sheet being less than 0.254 cm (100 mils) thick;

b) a middle layer of a self-adhering, water resistant, sealing material for sealing punctures in the sheet, the layer being less than 0.254 cm (100 mils) thick, the sealing material covering at least a portion of one of the surfaces of the sheet, the sealing material being sufficiently tacky that it adheres to the sheet and can be pulled into a puncture in the sheet by the object that causes the puncture, the sealing material having a sufficiently high viscosity at 38°C (100°F) that it does not flow through a puncture in the sheet, the sealing material comprising a polyurethane elastomer; and

c) an inner anti-tack barrier on the layer of sealing material for preventing the layer of sealing material from sticking to itself.

12. The swimming pool of claim 11 in which the elastomer is a polyether polyethane elastomer.

13. The swimming pool of claim 11 in which the layer of sealing material is less than 0.127 cm (50 mils) thick.

14. A tent comprising side walls, each having an exterior surface and an interior surface, at least a portion of one of the side walls comprising:

a) an exterior, puncturable sheet formed of cloth or polymeric material, the sheet being less than

100 mils thick;

b) a middle layer of self-adhering, water-resistant, sealing material for sealing punctures in the sheet, the layer being less than 0.254 cm (100 mils) thick, the sealing material covering at least a portion of one of the surfaces of the sheet, the sealing material being sufficiently tacky that it adheres to the sheet and can be pulled into a puncture in the sheet by the object that causes the puncture, the sealing material having a sufficiently high viscosity at 38°C (100°F) that it does not flow through a puncture in the sheet, the sealing material comprising a polyurethane elastomer; and

c) an interior antitack barrier on the layer of sealing material for preventing the layer of sealing material from sticking to itself.

15. The tent of claim 14 in which the elastomer is a polyether polyurethane elastomer.

16. An inflatable article, at least a portion of the walls of the article comprising:

a) an exterior, flexible, puncturable sheet formed of cloth or polymeric material, the sheet being less than 100 mils thick;

b) a middle layer of a self-adhering, waterresistant, sealing material for sealing punctures in the sheet, the layer being less than 0.254 cm (100 mils) thick, the sealing material covering at least a portion of one of the surfaces of the sheet, the sealing material being sufficiently tacky that it adheres to the sheet and can be pulled into a puncture in the sheet by the object that causes the puncture, the sealing material having a sufficiently high viscosity at 38°C (100°F) that it does not flow through a puncture in the sheet, the sealing material comprising a polyurethane elastomer; and

c) an interior antitack barrier on the layer of sealing material for preventing the layer of sealing material from sticking to itself

17. The article of claim 16 in which the elastomer is a polyether polyurethane elastomer.

18. A roof comprising fragmented rock on top of plastic sheeting, the sheeting comprising:

a) an upper flexible, puncturable sheet formed of cloth or polymeric material, the sheet being less than 100 mils thick;

b) a middle layer of a self-adhering, waterresistant, sealing material for sealing punctures in the sheet, the layer being less than 0.254 cm (100 mils) thick, the sealing material covering at least a portion of one of the surfaces of the sheet, the sealing material being sufficiently tacky that it adheres to the sheet and can be pulled into a puncture in the sheet by the object that causes the puncture, the sealing material having a sufficiently high viscosity at 38°C (100°F) that it does not flow through a puncture in the sheet, the sealing material comprising a polyurethane elastomer; and

c) a lower anti-tack barrier on the layer of sealing material for preventing the layer of sealing material from sticking to itself.

19. The roof of claim 18 in which the elastomer is a polyether polyurethane elastomer.

20. A self-sealing waterbed mattress comprising a polymeric, puncturable envelope and an internal layer of a self-adhering, water-resistant, sealing material for sealing leaks in the envelope, the sealing material being

5 sufficiently tacky that it adheres to the envelope and can
be pulled into a puncture in the envelope by the object
that causes the puncture, the sealing material having a
sufficiently high viscosity at 38°C (100°F) that it does
not flow through a puncture in the envelope, the sealing
10 material comprising a polyether polyurethane elastomer.

21. The waterbed mattress of claim 20 in which
the mattress has a top surface, a bottom surface, and side
surfaces, and the sealing material is only at the top and
side surfaces, and not the bottom surface.

22. The waterbed mattress of claim 20 or 21
including an anti-tack material on the inside surface of
the layer of sealing material for preventing the sealing
material from sticking to itself.

23. The waterbed mattress of claim 20 in which
the polyurethane comprises the reaction product of (i)
polyoxypropylene glycol or polyoxybutylene glycol and (ii)
an aromatic diisocyanate.

24. The waterbed mattress of claim 22 in which
the anti-tack material is only at the top and side
surfaces, and not the bottom surface.

25. The waterbed mattress of claim 22 in which
the anti-tack material comprises polyethylene sheet.

26. A method for fabricating a self-sealing
waterbed mattress, the mattress comprising a polymeric
puncturable envelope and an internal layer of a tacky,
cured, self-adhering, water-resistant, sealing material
5 for sealing leaks in the envelope, the sealing material

adhering to the envelope and having a sufficiently high viscosity at 38°C (100°F) that it does not flow through a puncture in the envelope, the method comprising the steps of:

- 10 (a) selecting first and second sheets of polymetric material;
- (b) applying sealing material before it cures to the top sheet;
- (c) allowing the sealing material to at least partially cure; and
- 15 (d) after step (c), heat sealing the top sheet and the bottom sheet together along their periphery to form the envelope.

27. The method of claim 26 in which the sealing material is a polyether polyurethane elastomer.

28. The method of claim 26 in which the sealing material is tacky and the mattress includes an internal barrier secured to the sealing material for keeping the sealing material from sticking to itself, the
5 method including the step of applying the barrier to the at least partially cured sealing material before the step of heat sealing.

29. The waterbed mattress of claim 22 in which the anti-tack material comprises polymeric foam.

30. The waterbed mattress of claim 29 in which the foam is polyurethane or polyethylene foam.

31. A waterbed mattress having a top wall, a bottom wall, and side walls and comprising:

- (a) a polymetric envelope;
- (b) an internal layer of a self-adhering

5 adhesive sufficiently tacky to stick to the envelope, the adhesive sticking to at least the top wall of the mattress; and

(c) an internal polymeric foam barrier secured to the adhesive for heat insulating the mattress.

DATED this TWENTY EIGHTH day of FEBRUARY 1984

MONTEREY MANUFACTURING CO.

Patent Attorneys for the Applicant
SPRUSON & FERGUSON

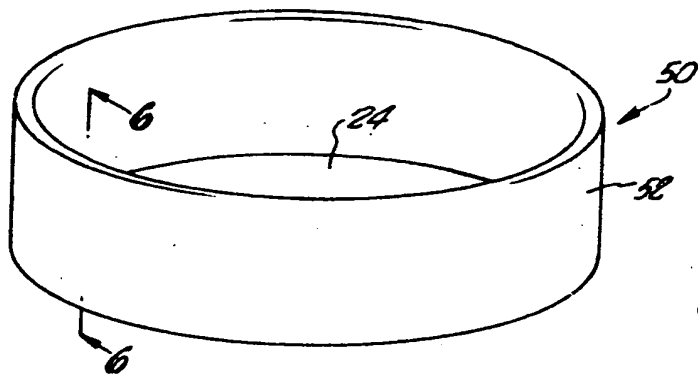


FIG. 5.

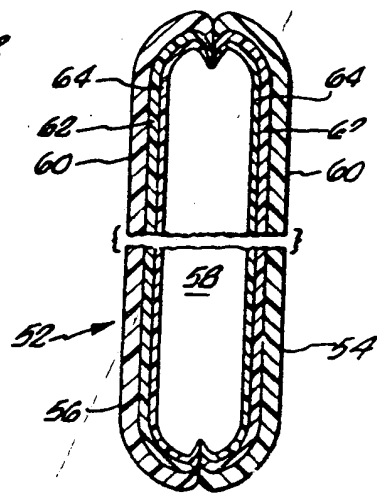


FIG. 6.

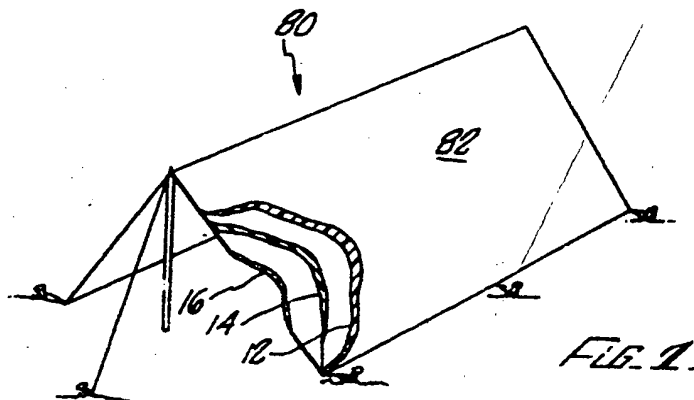


FIG. 1.

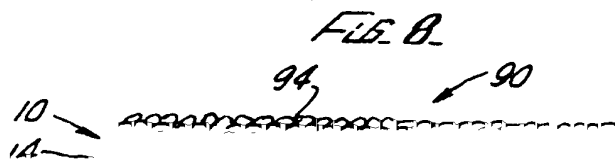


FIG. 8.

FIG. 1.

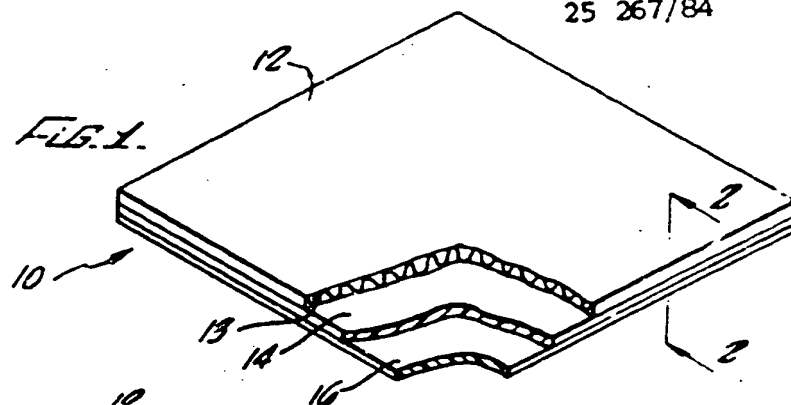


FIG. 2.

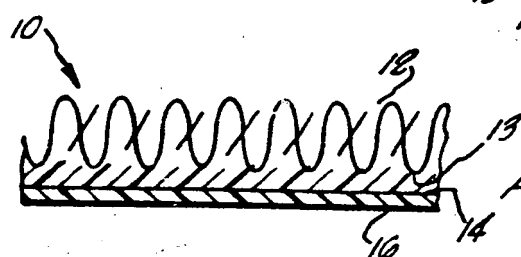


FIG. 3.

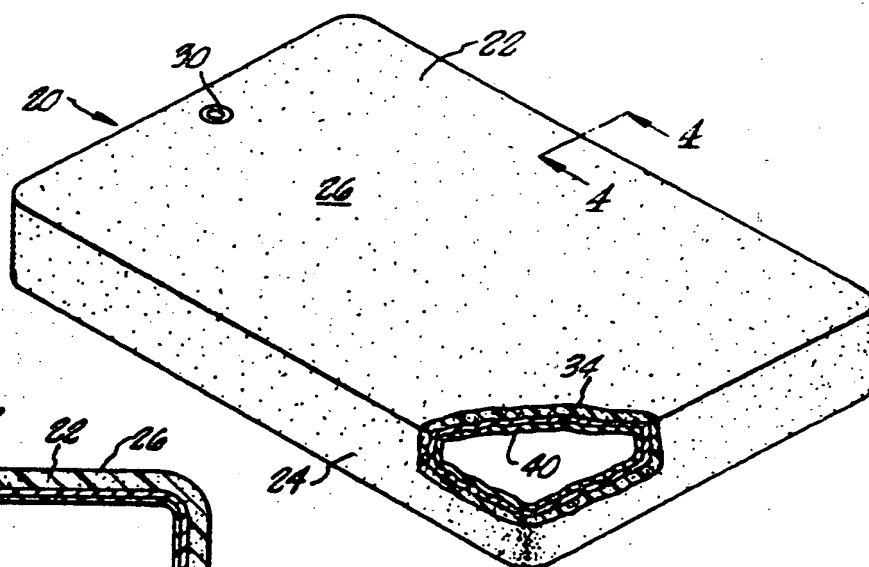


FIG. 4.

